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PATENT

AMENDED CLAIMS

1. (currently amended) A fluid heat exchanger for use in a fluid heating system comprising:

a rapidly heatable inside tube;

a hollow outside tube surrounding said inside tube;

a fluid passing between said inside tube and said outside tube for circulation through said fluid heating system;

wherein said inside tube is rapidly heated so that said inside tube is heated throughout its entire length and said fluid is rapidly heated to a predetermined temperature for use in said fluid heating system.

2. (original) The fluid heat exchanger according to claim 1 wherein said outside tube is thin-walled.

3. (original) The fluid heat exchanger according to claim 1 wherein said inside and outside tubes have respective circular cross sections.

4. (original) The fluid heat exchanger according to claim 1 wherein said outside tube concentrically surrounds said inside tube.

5. (original) The fluid heat exchanger according to claim 1 further comprising an insulating layer surrounding said outside tube.

6. (original) The fluid heat exchanger according to claim 1 wherein said inside tube further comprises a rapidly heatable hot portion extending longitudinally within said inside tube.

7. (original) The fluid heat exchanger according to claim 1 wherein said outside tube defines an inside surface and said inside tube defines an outside surface, said inside and outside surface being electropolished.

8. (original) The fluid heat exchanger according to claim 1 wherein said fluid may be raised to a supercritical condition by said rapidly heatable inside tube.

9. (original) The fluid heat exchanger according to claim 1 wherein said fluid heat exchanger is of compact construction.

10. (original) The fluid heat exchanger according to claim 1 further comprising a temperature control system having at least one sensor located along said fluid heat exchanger in sensing communication with said fluid, said temperature control system

controlling the operation of said heatable inside tube by regulating said fluid temperature within a predetermined range based on fluid temperature readings taken by said temperature control system;

wherein said inside tube is rapidly heated by said temperature control system such that said fluid is rapidly heated to within said predetermined range for use in said fluid heating system.

11. (original) The fluid heat exchanger according to claim 4 further comprising at least one coiled wire interposed between said inside tube and said outside tube for maintaining concentricity between said inside and outside tubes.

12. (original) The fluid heat exchanger according to claim 4 wherein said inside tube defines an outside surface having longitudinally spaced raised regions extending outwardly therefrom such that concentricity is maintained between said inside and outside tubes.

13. (original) The fluid heat exchanger according to claim 6 wherein said hot portion coils longitudinally within said inside tube.

14. (original) The fluid heat exchanger according to claim 8 wherein said fluid comprises carbon dioxide.

15. (original) The fluid heat exchanger according to claim 12 wherein said raised regions proceed helically along said outside tube.

16. (original) The fluid heat exchanger according to claim 12 wherein said outside tube defines an inside surface, said inside surface having longitudinally spaced raised regions extending inwardly therefrom to maintain concentricity between said inside and outside tubes.

17. (previously amended) The fluid heat exchanger according to claim 13 wherein said inside tube further comprises a cold portion having opposed proximal and distal ends, said distal ends of said cold portion extending outwardly from opposing ends of said inside tube, said hot portion interposed between said cold portion for connection with respective said proximal ends of said cold portion within said inside tube;

wherein said cold portion receives electrical power from an electrical power source for rapidly heating said inside tube.

18. (original) The fluid heat exchanger according to claim 16 wherein said raised regions proceed helically along said outside tube.

19. (currently amended) A fluid heating system comprising:

a fluid heat exchanger defining a rapidly heatable inside tube;

a hollow outside tube surrounding said inside tube;

a fluid passing between said inside tube and said outside tube for circulation through said fluid heating system;

a temperature control system having at least one sensor located along said fluid heat exchanger in direct sensing communication with only said fluid, said temperature control system controlling the operation of said heatable inside tube by regulating said fluid temperature within a predetermined range based on fluid temperature readings taken by said temperature control system;

wherein said inside tube is rapidly heated by said temperature control system such that said fluid is rapidly heated to within said predetermined range for use in said fluid heating system.

20. (original) The fluid system according to claim 19 wherein said at least one sensor is positioned in the fluid flow stream.

21. (currently amended) The fluid system according to claim 19 wherein said at least one sensor is located within said ~~inside~~ outside tube.

22. (original) The fluid heating system according to claim 19 wherein said temperature control system further comprises a microprocessor-based controller.

23. (currently amended) The fluid heating system according to claim 19 wherein said at least one sensor may be located in the fluid flow stream and within said ~~inside~~ outside tube.

24. (original) The fluid heating system according to claim 19 wherein said at least one sensor comprises a thermistor.

25. (original) The fluid heating system according to claim 19 wherein said at least one sensor comprises a resistance temperature detector.

26. (original) The fluid heating system according to claim 19 wherein said at least one sensor comprises a thermocouple.

27. (original) The fluid heating system according to claim 19 wherein said fluid heating system raises the temperature level of said fluid in a substantially linear trend per unit of time.

28. (original) The fluid heating system according to claim 20 wherein said at least one sensor is located in a raised region formed along said outside tube.

29. (currently amended) A fluid heat exchanger for use in a fluid heating system comprising:

a rapidly heatable inside tube;

a hollow outside tube closely surrounding said inside tube, said inside and outside tubes collectively formable in a number of shapes;

said inside tube and said outside tube defining a passageway for a fluid passing therebetween for circulation through said fluid heating system;

wherein said inside tube is rapidly heated throughout its entire length for heating said fluid to a predetermined temperature for use in said fluid heating system.

30. (original) The fluid heating system according to claim 29 wherein said passageway defines a small cross-sectional area for said fluid to pass therethrough.

31. (original) The fluid heating system according to claim 29 wherein said shapes collectively formable with said inside and outside tubes define a compact construction.

32. (original) The fluid heating system according to claim 30 wherein said passageway defines an annular cross-sectional area.

33. (original) The fluid heating system according to claim 30 wherein the convective film coefficient along the outer periphery of said rapidly heatable inside tube is a large value.

34. (currently amended) A fluid heat exchanger for use in a fluid heating system comprising:

a rapidly heatable inside tube having an outer peripheral surface;

a hollow outside tube closely surrounding said inside tube substantially concentrically, said inside and outside tubes collectively formable in a number of shapes;

said inside tube and said outside tube defining a passageway having a small cross-sectional area therebetween;

a fluid passing along said passageway ~~at a low flow rate~~ for circulation through said fluid heating system; and

a temperature control system having at least one sensor located along said fluid heat exchanger in sensing communication with said fluid, said temperature control system controlling the operation of said heatable inside tube by regulating said fluid temperature within a predetermined range based on fluid temperature readings taken by said temperature control system;

wherein said outer peripheral surface of said inside tube having a high convective film coefficient value is rapidly heated throughout its entire length by said temperature control system such that said fluid is rapidly heated to within said predetermined range for use in said fluid heating system.